DOCUMENT RESUME

ED 427 687 IR 019 238

AUTHOR Bouras, Christos; Lampsas, Petros; Bazaios, Antonis; Tsintilas, Giorgos

TITLE Web-Enabled Distance Education Environment.

PUB DATE 1998-11-00

NOTE 7p.; In: WebNet 98 World Conference of the WWW, Internet, and Intranet Proceedings (3rd, Orlando, FL, November 7-12, 1998); see IR 019 231. Figures may not reproduce clearly.

PUB TYPE Reports - Descriptive (141) -- Speeches/Meeting Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS *Computer Assisted Instruction; *Computer Interfaces; Computer Software Development; *Computer System Design; *Distance Education; Educational Environment; Foreign Countries; Instructional Design; Interaction; Telecommunications; World Wide Web

IDENTIFIERS *Client Server Computing Systems; Greece; Java Programming Language; *Learning Environments

ABSTRACT

This paper describes the design of a synchronous World Wide Web-based distance education environment developed at the Telematics Laboratory of Computer Engineer and Informatics Department (CEID) and Computer Technology Institute (Greece); the environment uses telematics services to conduct lessons over computer networks, simulating a traditional classroom environment with the live presence of a teacher, where all interactions among students, teacher, and courseware can be realized. Topics discussed include: the general architecture of the teletraining tool, including major advantages, specific advantages to trainees, and the selection of JAVA as the programming language; functionalities of the teletraining tool, including services provided by the teletraining server, the trainer's client, and the trainee's client; and the user interface of the trainer's and trainee's client. Two figures present the protocol stack and the user interface of the trainee's client. (AEF)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 427 687

Web-Enabled Distance Education Environment

Christos Bouras, Petros Lampsas, Antonis Bazaios, Giorgos Tsintilas, Computer Technology Institute, Patras, GR-26441, Greece, Tel: +30 61 994318, E-mail: {bouras, lampsas}@cti.gr, {bazaios, tsidilas}@ceid.upatras.gr

Abstract: As the new network computer technology forces into every aspect of daily life, many things change in a rather rapid way, compared to what we were used to until recently. One of the most important aspects in the social activity of people, Education, could not be an exception. Advances in network infrastructures and telematics services, combined with multimedia techniques and powerful personal computers provide the opportunity to make a network-based multimedia system for distance learning (teletraining) a real fact.

Introduction

The value of accurate and on-time data and information in world-wide range towards the Information Society, has altered the needs for education. Today, instead of having "once-in-a-life" education, is more likely to follow the pattern of "life-long" learning. The concept of Teletraining is able to replace the time-and-money-consuming status of moving around in order to acquire the knowledge needed, since via computer networks the experts can give their knowledge to all that have access to the Web. Additionally, an unlimited variety of themes can be provided by a PC, in the context of a well organised, easy-to-handle, brief or detailed, continually updated lesson.

The potentials of Teletraining has prompted many Software Development Companies and Educational Institutes (Universities, Colleges) to invest and work on it. Microsoft has already developed and distributed NetMeeting, which provides the ability of working collaboration between users in different locations, using TCP/IP protocol suite. NetMeeting provides point-to-point video and audio real time communication, multipoint data conferencing and application sharing. It can also interact with other multimedia network applications provided that they support the same ITU-T standards that NetMeeting use.

Another tool that can be used for teletraining purposes is WhitePine's CU-SeeMe 3.0, which among others supports Phone Book with Graphical Contact Cards, Directory Services for locating other CU-SeeMe users, H.323 Standards based video codec (H.263), White Board (T.120), Motion JPEG (M-JPEG) video codec for high quality and video over LANs and ISDN. However, the most significant functionality of it is the TCP/IP support for LAN/WAN conferencing, using the reflector policy, with the ability to view up to 12 participant windows simultaneously, supported by Caller ID for incoming connections and Parental Control Management.

What has been mentioned above, have inspired and motivated the research efforts that resulted in the design and implementation of a "synchronous" distance education environment using WWW, which represents the continuity of the research work that has started three years ago in the Telematics Laboratory of Computer Engineer and Informatics Department (CEID) and Computer Technology Institute (CTI). Telematic services are used for the conduction of lessons over computer networks and this environment can be thought of, as a simulation of a traditional classroom setting with the live presence of a teacher, where all interactions among students, teacher and courseware can be realised.

General Architecture of Teletraining Tool

The overall architecture is based on the Teletraining Server, that is responsible for the communication between the trainer and the trainees. The main idea of the proposed architecture is to setup a single Teletraining Server per Training Center. The concept of the Training Center is a powerful computer with a Web server and the tool's Teletraining Server installed. All the slights needed for the lesson will be stored there and for everyone taking part in the lesson, the computer will function as a reflector for the audio, video, chat, and White Board

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☐ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
G.H. Marks
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

IR019238

BEST COPY AVAILABLE

data. The Server is capable of taking over multiple lectures. Furthermore, the interaction between the trainer and the trainees is performed by the Server, which implements the commands of the users.
Both the trainer and the trainees are connected to the Server through custom designed Clients that provide them with the ability of interacting with the Server through a user-friendly Graphical User Interface (GUI).
The major advantages of the proposed architecture are:

- Interactive communication between teacher and students over the Internet, including audio, video and data exchange.
- Modular design in the sense that the application specific network protocols are exclusively responsible for the interaction between the Clients and the Server.
- The physical appearance of the trainer is not required at the Teletraining Center since he can manipulate the lesson, through the Teletraining Server, from his PC provided that there is installed the trainer's client software, which interacts with the Teletraining Server.
- Uniform approach of the Graphical User Interface of both the trainer and the trainees. The different functionality of the Clients for the trainer and the trainees is implemented by means of enabling and disabling controls of the User Interface and the corresponding modules of the application.
- Ease of use. The user interface is designed in order to hide from the user most of the low level details that are needed for the interconnection of the various computer systems over the network.
- Being an opened-environment tool since it was developed in Java, in order to work independently of platforms.
- Reduced costs for development and administration and increased flexibility. This implies that a single Server is capable of taking over multiple lectures given by different trainers. Thus, the effective operation of the Teletraining Tool requires the setup of a single Teletraining Server per Training Center.
- Provision of interesting lessons incorporating JPEG, GIF images and offers a variety of tools that can be used to enhance these images with remarks and drawings, thus making the lesson material interesting and attractive.

It is obvious that the software tool can be put into immediate use through the use of TCP/IP protocol suite, and can greatly aid the implementation and realisation of the distance education service. This use can offer a number of advantages to the persons that will attend the classes, among which are the following:

- The trainees do not suffer from lost productive time, since they have the flexibility to attend the lessons in more negotiated time periods, even outside their work hours.
- The creation of friendly and continually modified lessons can instigate the interest of the trainees for them.
- The use of Telematics reduces the need for experts and the cost of the educational process.

A very significant characteristic of the tool is the selection of JAVA as the programming language with which it was developed. During the design phase, it was considered crucial the demand for full portability of the tool. That is, the tool should be able to be executed independently of the workstation of the user. It should be able to work either under Windows 95 or a UNIX System or a Macintosh. At the same time it should have the ability to use the Internet infrastructure for reaching every potential user. In order to achieve what was mentioned above and to build a very easy-to-use tool as well, JAVA was selected.
As a result of the above, the server of the Teletraining was implemented as a JAVA application. The server should be installed in each Training Center in the same workstation with a Web Server in which all the Web pages that a lesson would use, reside. The client of the Trainer on the other hand, is also a JAVA application that should be in each trainer workstation. It can be locally executed in order either to build and prepare a lesson and later to store it in the Teletraining server or to actually conduct a lesson in real-time.
The client package of the trainee though, is consisted of several JAVA applets. Each applet is responsible for the respective functionality (Chat, White Board, Text Editor, Audio Communication, Videoconference). All the applets resides in a single workstation and can be accessed by every trainee through a Web Browser (Internet Explorer, Netscape Navigator) as easily as they reach any other address in the WWW. The only restriction is that the trainee-user should have acquired previously a Login and a Password from the Teletraining server, using the appropriate Web pages for registration in a lesson.
In the following, a complete functional specification of the Server and the Clients will be given.

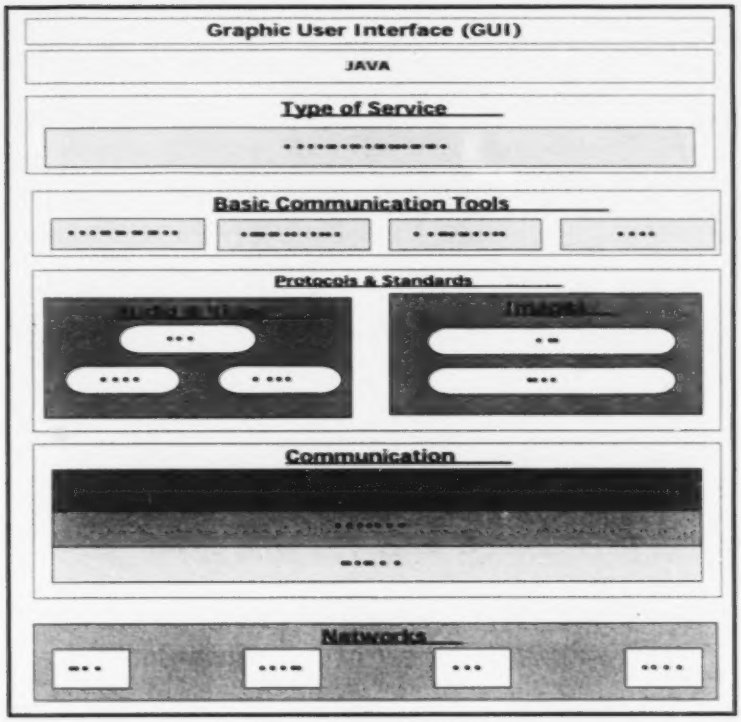

Figure 1. Protocol stack.

Functionalities of the Teletraining Tool

Functional Specification of the Teletraining Server

The Server of the Teletraining Tool is responsible for the interaction between the trainer and the trainees before and during the lecture. More specifically, the Server provides both the trainer and the trainees with the following services:

- Lecture Announcement. Once a lecture is prepared, the Teletraining Server uses the network to announce it by notifying all possible interested trainees, possibly by a bulletin board system, a WWW server, or a mechanism of distribution lists. The notification consists of a simple announcement of the lecture that calls the potential trainees for participation.
- Lecture registration. Trainees that have been notified, can simply register their interest in the lecture. The Server automatically registers the corresponding trainees in order to deliver the course material to them and to automatically handle the network connections during the lecture.
  - Distribution of the material for the lecture. After the registration process, the material for the lecture is distributed to all the trainees that will participate to the specific lecture. The Server is exclusively responsible for the distribution of the material, that may take place either before (off-line) or during the lecture (on-line).
- Access to previous lectures' material. The Server stores previous lectures' material so as to provide access to them to any interested trainee. Thus, the material of any previous lecture will be available to all the trainees for later review.

BEST COPY AVAILABLE

- Lecture presentation. During a lecture, the Server will operate according to the commands of the trainer so as to ensure the proper presentation of the lecture to the trainees. Furthermore, the Server offers the following operations:
  - Submission of written questions from the trainees. The written questions are transmitted to the trainer. The trainer answers the questions and both the questions and the answers are transmitted automatically to all the trainees.
  - Submission of requests for oral comments. The trainees have the ability of inquiring and the trainer will either accept or reject the inquiries. In the former case, the trainer will give permission to the requester and the oral comment will be broadcast to all the participants of the lecture.
  - Session management. Because of the nature of the multiple data types that have to be transmitted during a lecture, some media handlers that will take over the synchronisation and the appropriate representation are necessary, especially when dealing with audio, video, high quality images, and structured documents. Another handler will be responsible for the interaction among the trainer and the trainees.

Functional Specification of the Trainer's Teletraining Client

The trainer's client is meant to give the opportunity for the preparation and presentation of a lecture to a selected audience through a friendly user interface. This client interacts with the server in order to guide the lecture according to the trainer's will. Within these directions the trainer's client provide the following services:

- A tool for the creation of lectures. Each lecture will be prepared from the trainer with this tool. It consists of a hypermedia document that will be described in a suitable language and consisted of several slights. For all the slights of a lecture is assigned a hierarchy of dependencies which organises the notional succession of it. A similar hierarchy exists for a group of lectures comprising a seminar. Each slight might consist of text, still images and connections that would refer to others slights or files of audio or video. The tool for creating slights provide the following abilities:
  - Creation and processing of slights
  - Request and acquire information from the WWW
  - Notional succession of lectures and seminars
  - Update the lecture announcement's board
- Off-line reading and processing of existing lectures. This functionality holds only for the trainer that created the lecture or someone who has the appropriate privileges.
- Selection of the audience. It allows the trainer to select the members of his audience from those who requested permission to attend a lecture.
- Guidance of the lecture's flow. During the lecture, the trainer interferes dynamically in the flow of the lecture. Thus, the client interacts with the server in order to execute the wills of the trainer. As a result the following abilities are supported:
  - Interchange and annotation of the slights. That can be done by notes, underlying, natural speech and video with the face of the trainer whenever is possible.
  - Admission and answering of the possible questions by the trainees. The trainer is able to admit or not written questions or requests for oral statements. He can also respond with orally speak or by writing to any kind of a question. Moreover, he can withdraw anytime the permission for speaking from any of the trainees. Finally, he controls the flow of questions/answers to the rest of the virtual class.

Functional Specification of the Trainee's Teletraining Client

The trainee's client is a tool that requires only a Web browser in order to be executed. It enables the trainee to attend a lecture and to interact with the trainer through the teletraining server. It specifically provides the following services:

- Lecture's Attendance. There exists a White Board for the slights and a space for text that accompany them.

- Questions. Ability for interaction with the trainer in order to submit questions written or audio-recorded.
- Display of the trainer in an embedded window (video) in the central interface of the application. Ability to disable that window if the available bandwidth is not able to support the live broadcast of the video of the trainer. A similar ability is provided for the audio support.
- Store/Delete of lecture. The lectures or specific parts of them that are selected from the trainee can be stored locally in their workstations for future use.

User Interface

Trainer's Client

The Trainer through the basic menu "Server", "Server Location" has the ability to specify the server's Internet address and afterwards to connect to the server pressing "Connect Server" from the basic menu "Server".
Using the "Window" menu the trainer can choose any time which of the Services (White Board, Chat, Video, Select Slights, Selected Slights, FTP, Statistics) to be on the screen.
All the available slights for each lesson can be loaded from the trainer through the Select Slights Service. Successively, the trainer chooses the specific slight at the order to be displayed on all clients.
Upon that slight he can add some drawings (rectangular, straight lines, consecutive lines, etc.) and text using the White Board menu. Finally using the Chat Service he can send to all trainees text messages guiding the lesson and give the opportunity to the trainees to break in the session.

Trainee's Client

Every trainee can access a session using a Web browser in order to run the client's applets. Before that, he should enter the server using his Login and Password which he should have acquired previously by the server.

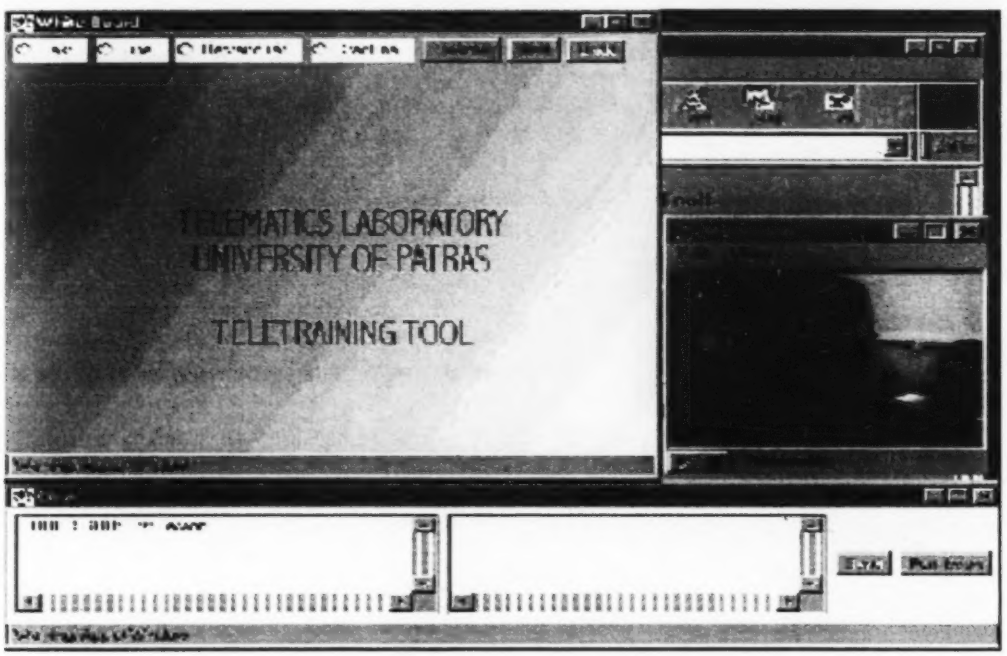

Figure 2. User Interface of the Trainee's Client

BEST COPY AVAILABLE

Entering the server with the Login and Password, the applets are executed automatically and the trainee could then choose which windows (Services) he wants to be active.
In the Video window, he can watch the face of the trainer. If the network bandwidth cannot support this service the trainee can deactivate that service.

Conclusions and Future Work

Initially, the Web was a mechanism to retrieve distributed information, with little interaction available. Java now allows full interaction with server and discussion with other users. It also enhances the Web's functionality by allowing a collection of Web-based documents to serve as a focus for synchronous collaborations.
In the present implementation the teletraining server controls thoroughly the lesson's flow. That allows the trainer to manipulate the lesson according to his will. On the other hand the fact that the server operates as a reflector for video, audio streams and for the White Board and Chat data, creating one connection for each user, the bandwidth required for a large number of trainees would be prohibitively big when all services are enabled.
In order to solve the problem that is described above, we have planned for future work to make the application use the Internet's MBONE technology, which JAVA gives the opportunity to take advantage of.

References

[1] [Bazaios & Tsidilas]. Design and Development of an On Line Teletraining tool". Diploma Thesis, University of Patras, Computer Engineering and Informatics Department.

[2] *"Multimedia Architecture offering Open Distance Learning Services over Internet"*, A. Bazaios, C. Bouras, P. Lampsas, P. Spirakis, P. Zarafidis, A. Zoura, International Conference on Telecommunications - ICT 98, Chalkidiki 22-25 June 1998, Greece.

[3] [Newcomb et al., 1991]. The HyTime Hypermedia/Time - based Document Structuring Language, Communications of the ACM, November 1991.

[4] [Nicolaou]. An Architecture for real-time communication systems. IEEE Selected Areas In Communications, vol8, no3, Apr.1990.

[5] [R.Steinmetz]. Synchronisation properties in a multimedia system, IEEE Selected Areas In Communications, vol8, no3, Apr.1990, pp.401-412.

[6] [Shepherd, D.Hutchinson, F.Garcia, G. Coulson]. Protocol support for multimedia applications. Computer Commun. vol.15, July 1992, pp.359-366.

[7] [N.U.Qazi, M.Woo, and A.Grafoor]. A synchronisation and communication model for distributed media objects. In proc. ACM Multimedia 1993, pp.147-155.

[8] [Herng-Yow Chen & Ja-Ling Wu]. Multisync: A synchronisation model for multimedia systems. IEEE Journal on Selected Areas in Communications, vol. 14, No.1, January 1996.

[9] [Vogt]. Quality - of - service management for multimedia streams with fixed arrival periods and variable frame sizes. Multimedia Systems 3:66-75, 1995.